ELECTRIC MACHINE HAVING A COMMUTATOR

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~~Background of the Invention~~

German Patent No. 3131759

A ~~German Patent 31 31 759 C2~~ describes the manufacture of an electric machine having a combination of a commutator, at least one brush that can be pressed against the commutator and a supply of oil lubricant. When the electric machine is assembled, the commutator is sprayed with an oil lubricant. In spraying, oil lubricant cannot be prevented from entering the electrically insulating grooves between the collector bars of the commutator. In operation of the electric machine, the oil lubricant on the collector bars counteracts electric arcing, also called brush sparking, and thus prevents arcing from pitting the commutator and thus causing uneven running of the electric machine. In order for the supply of lubricant to be as large as possible while also permitting adequate electric contact between the bars of the commutator and the minimum of one brush, small balls are thrown against the bars of the commutator before spraying to produce small recesses which function as storage reservoirs for the oil supply or increase the reservoirs.

A collector for such an electric machine is manufactured, for example, by injecting a thermoplastic material into an essentially tubular blank made of copper and by cutting the blank at regular intervals measured in the circumferential direction, creating grooves and bars electrically insulated from one another in the collector. These grooves also extend into the thermoplastic material. Brushes for such a collector are generally provided with grooves running in the circumferential direction of the collector on the end facing

the collector for the purpose of creating relatively high abrasion when the electric machine is initially started, so the brushes adapt to the outside contour of the collector on these end faces as rapidly as possible. A rapid run-in is desired, so that the originally small contact faces of the brushes rapidly increase in size and thus the electric amperage per unit of contact area declines. Abrasion fines from the brushes occurring during run-in as well as from the copper collector bars conduct electricity and therefore can lead to a parasitic current flowing from one collector bar to the next when this abrasion collects in the grooves between the collector bars. If the collector is sprayed with an oil lubricant according to German Patent No. 31 31 759 ~~C2~~, collection and adherence of conductive abrasion fines in the slots is promoted. A high current flow due to collected abrasion fines can in principle "burn off" the collected abrasion fines and thus produce a type of thermal cleansing of the grooves. However, such high currents occur only with heavy loads on the electric machine. If such an electric machine is used as the drive for a fan in a motor vehicle, it often happens that such an electric machine is operated only at a low speed and a low amperage to minimize noise. Consequently, the possibility cannot be ruled out that the desired thermal cleaning of this type might not occur.

An example of a brush that permits a rapid run-in is ~~known~~ described in German Patent No. from ~~Unexamined German Patent~~ 28 56 112.

~~British Patent~~ British Patent No. 1,591,349 describes how brushes are completely impregnated with an oil that is not fluid or with a wax that does not melt during operation of the engine, e.g. using a gelling agent, with the goal of extending the lubrication to the entire lifetime of the brushes. Thus, all

the abrasion fines from the brushes contain lubricant.

Summary of the Invention

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The electric machine ~~having the characterizing features of Claim 1~~ according to the present invention and ~~also~~ the method ~~having the characterizing features of Claim 2~~ yield the advantage that an oil-free and lubricant-free collector can be installed in the electric machine, and a supply of oil lubricant can be introduced into the electric machine using at least one brush as a supply container. The goal here is to keep the supply of oil lubricant minimal but sufficient for the time of adaptation of the brush end faces to the curvature of the collector bars and for smoothing the collector bars in friction contact with the brushes. Therefore, after such run-in of a combination of collector bars and brushes, the oil lubricant held by the brushes can be used up, so that most of the lifetime of the electric machine elapses without the deleterious presence of oil lubricant when brush abrasion fines develop. The risk of the grooves between the collector bars becoming filled with conductive abrasion fines in the long run and conducting parasitic currents is thus low accordingly.

~~Alternative possibilities for carrying out the method according to Claim 2 are given through the measures characterized in the subordinate claims. For example,~~ The oil lubricant may be sprayed onto the respective brush at the end face, with the amount being allocated to the brush being determinable by the spray time, for example. ~~The~~ An alternative according to ~~Claim 4~~ the present invention is used when the oil lubricant is comparatively viscous and the depth of penetration of this lubricant into the brush is to be

controlled. Claim 1 concerns a brush whose characterizing features ensure a lubricant supply in an electric machine having a collector.

Brief Description of the Drawings

The electric machine according to the present invention is illustrated in the drawing and described in detail below. Figure 1 shows a longitudinal section through the electric machine having a collector and brushes; Figure 2 shows a front view of the collector and the respective brushes, and Figure 3 shows a detail of the brushes used as an example.

Detailed Description

Electric machine 2, schematically shown in Figure 1 as an example, has a first pot-type casing part 3 and a second pot-type casing part 4, permanent magnets 5, 6 accommodated in pot-type casing part 3, an armature 7 that can rotate between permanent magnets 5 and 6 and a collector 8 allocated to armature 7, a shaft 9 carrying armature 7 and the collector and connecting them to one another in a non-rotatable manner, a friction bearing 10 next to collector 8 and, at a distance from that, another friction bearing 11 next to armature 7. Friction bearing 10 is composed of a friction bearing bush 12 and a shaft segment 13 mounted in friction bearing bush 12, forming a journal-like end of shaft 9 in this embodiment. Friction bearing bush 12 is sintered according to the related art, for example, made of metal or a combination of metals and impregnated with an oil lubricant. Friction bearing bush 12 is held by a bearing plate 14 molded on casing part 4, for example. In a similar manner, another bearing plate 15, for example, is molded on

casing part 3 and also accommodates a sintered friction bearing bush 16. Another shaft segment 17 extends rotatably inside sintered bearing bush 16, so that shaft segment 17 and sintered bearing bush 16 form friction bearing 11. Shaft segment 17 has a fan wheel or fan impeller (not shown) mounted on it.

In this example, two brushes 19, 20 made either partially of carbon or mainly of a pressed metal powder or alloys according to the related art are provided for collector 8. The mechanical guidance of brushes 19 and 20 should permit their electric contacting by way of brush mounts 21 and 22. In addition, it is pointed out that three or more brushes can be assigned to collector 8 in some cases.

A dust guard 25 may be provided on shaft 9 between collector 8 and friction bearing bush 12.

According to Figure 2, collector 8 has an insulating carrying body 26 in a non-rotatable mount on shaft 9 carrying a number of bars 27 made of copper or a copper alloy. In a manner known from the related art, collector 8 may be made of an essentially tubular blank into which a thermoplastic material can be injected to form the insulating carrying body, after which individual bars 27 as shown in Figure 2 are formed from ~~said~~ the tubular blank by the arrangement of grooves 28. Eight bars are illustrated in Figure 2 as an example. In deviation from that, the design engineer may also select a different number of bars.

Figure 2 shows end faces 29, 30 of brushes 19, 20, with these end faces 29 and 30 being directed against collector 8 for electrically conducting contact with bars 27 of this

collector 8. In the example shown here, each of two brushes 19, 20 is prepared with an oil lubricant, for example, along a partial length 19a and 20a marked graphically starting from these end faces 29 and 30. This oil lubricant, the choice of which can be left up to those skilled in the art for the combination of collector and brushes, may be sprayed or otherwise applied with or without diluting before installing brushes 19, 20 in electric machine 2. Meanwhile, those skilled in the art will have the option of selecting between several methods of applying or introducing a supply of oil lubricant suitable for the intended purpose to end faces ~~19~~ 29, ~~20~~ 30 of such brushes 19, 20 or through these end faces to partial lengths 19a, 20a of brushes 19, 20.

It is essentially sufficient if one of two brushes 19 or 20 is provided with a supply of oil lubricant because all collector bars 27 come in contact with the lubricant, starting from this prepared brush. If both brushes 19 and 20 are each installed and provided with a supply of lubricant, this yields the advantage that only one type of brush need be kept in stock. With each of the brushes provided with lubricant, it is also certain that any electric machine is lubricated in the sense of ~~this~~ the present invention.

Figure 3 shows another illustration of brush 20. Brush 20 here is rotated 90° in comparison with Figure 2. This makes grooves 31, which are aligned in the circumferential direction of collector 8, visible. As mentioned in the introduction to the description, these grooves 31 permit a rapid adaptation of the curvature of end faces 29 and 30 of brushes 19 and 20 to the external shape of bars 27, with the goal of rapidly creating a contact surface corresponding to the respective dimensions of brushes 19, 20 in the

circumferential direction of collector 8. When such grooves 31 are cut into brushes 19, 20 before applying oil lubricant, they are also useful as storage containers for the oil lubricant.